REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the present amendment and the following discussion is respectfully requested.

Claims 1-2 and 27-40 are presently active in this application; Claims 1-2 having been amended by the present amendment, Claims 3-26 having been canceled, and Claims 27-40 having been added.

In the Official Action, Claims 1, 2, 15, 17-21, 23, and 24 were rejected under 35 U.S.C. § 102(e) as being anticipated by Yamada et al (U.S. Pat. No. 6,134,096). Claim 16 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamada et al in view of Muka (U.S. Pat. No. 5,854,468) or Armstrong et al (U.S. Pat. No. 6,072,163). Claims 22, 25, and 26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamada et al in view of Kobayashi et al (U.S. Pat. No. 5,908,799).

Firstly, Applicants acknowledge with appreciation the courtesy of Examiner Paik to conduct an interview on August 21, 2003 and a subsequent interview of March 9, 2004 to discuss the outstanding issues in this case. As noted on the first Interview Summary Sheet, Applicants' representative pointed out that the claimed convex body having a point contact to a semiconductor wafer was distinguishable over the planar surface of the projection bodies in Yamada et al. Examiner Paik maintained that a planar surface in Yamada et al encompasses a point contact, and without further structure, the claims would not overcome Yamada et al. As noted on the second Interview Summary Sheet, changes regarding the incorporation of impurity elements of Na, B, and Y were discusses and changes clarifying conical (and similar) shapes were discussed. As noted on the Interview Summary Sheet, Examiner Paik

suggested that clarification of the discussed "point contact" to a tangential point contact may differentiate the claimed inventions from Yamada et al. No agreement on patentabiity was reached.

Accordingly, to expedite prosecution of this application, the present amendment clarifies the structure of the point contact in independent Claims 1 and 2, as recommended during the second interview, to define that only one point of contact is provided to the semiconductor wafer at the convex body or the convex portion recited in the claims.

Amended claims 1 and 2 are supported by the originally filed claims and at lines 5 to 7 on page 1, lines 8 to 10 on page 3, lines 10 to 11 on page 7, and lines 32 to 34 on page 7 in the specification. Newly added Claims 27 and 28 are supported by the originally filed claims, by Figs. 8 and 9, and at lines 5 to 7 on page 1, lines 10 to 11 on page 7, lines 10 to 12 on page 8, and lines 22 to 23 on page 8 in the specification. Newly added Claims 29 to 31 and 33-39 are supported by canceled dependent Claims 15 to 26. Newly added Claim 32 is supported at lines 4 to 7 on page 13. Newly added Claim 40 is supported at lines 24 to 25 on page 19.

Firstly, Applicants point out that the thermal conductivity of a ceramic is lower than that of a metal. The thermal conductivity of AlN is 180 W/m-K at the highest, but is still lower than the thermal conductivity of Al (236 W/m-K) or Cu {403 W/m-K). Therefore, on the heating surface of a ceramic substrate, a higher-temperature portion having a pattern similar to the heating element pattern is generated due to an uneven temperature distribution on the ceramic substrate. Further, a ceramic typically includes a sintering aid or impurities. Thus, there is a possibility that a semiconductor wafer will be contaminated.

According to the present invention, a convex body or a convex portion is formed on the surface of a ceramic substrate. With this constitution, a semiconductor wafer is held apart from the heating surface of the ceramic substrate. Accordingly, uniform heating of the semiconductor wafer is possible since heating is not adversely affected by the uneven heat temperature distribution pattern on the ceramic substrate. Additionally, the convex body or the convex portion makes one point contact with the semiconductor wafer, so that the semiconductor wafer is not subject to being contaminated by impurities, such as the claimed Na, B, and Y impurities.

Furthermore, since the convex body or the convex portion is formed on the surface of the ceramic substrate, there is no temperature difference between the ceramic heating surface and the convex body or the convex portion. Thus, the semiconductor wafer is not partially cooled when the wafer contacts with the convex body or the convex portion. Accordingly, the ceramic heaters of the present invention solve problems specific to ceramic heaters.

Metal heaters do not have problems such as the uneven temperature distribution and contamination of a semiconductor wafer. Since metal has a high thermal conductivity, the temperature of the heating surface is kept uniform.

Accordingly, Claims 1 and 2 define ceramic heaters including a ceramic substrate having a ceramic sintered body containing at least one of Na, B, and Y as an impurity element. The ceramic heater is constituted to have a structure such that a convex body or a convex portion thereof makes one point contact with a semiconductor wafer. These claims define that the semiconductor wafer can be held apart from a surface of the ceramic substrate and heated. As such, the semiconductor wafer can be heated without contamination of the

semiconductor wafer from the impurities elements in the ceramic sintered body and without having other uneven heat distribution of the ceramic heater being imposed on the semiconductor wafer.

Similarly, Claims 27 and 28 define ceramic heaters having a structure including a conical shape, a pyramidic shape, a spire shape, spherical shape, or hemispherical shape. Accordingly, the semiconductor wafer can be held apart from a surface of the ceramic substrate and heated, avoiding contamination of the semiconductor wafer from impurities from the sintering aids.

Hence, the claimed ceramic heaters solve problems specific to conventional sintered ceramic heaters.

Regarding Yamada et al, Yamada et al disclose an electrostatic chuck. The electrostatic chuck includes a substrate 18, an electrode 9, and a resistive heating element 19.[1] Gas-introducing holes 42 are formed in the substrate 18, and continued to a gas-diffusing depression 24A which surrounds a circular discoidal portion 27. Round projections 26 are provided on the discoidal portion 27. As illustrated in Figs. 6 and 7, projections 26 are columnar, and contact with the object by surface. Therefore, the chuck cannot prevent contamination of the object by impurities in the chuck. Further, the projections do not have any of a conical shape, a pyramidic shape, a spire shape, a spherical shape, and a hemispherical shape.

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[1] Yamada et al, col. 11, line 29, to col. 12, line 26.

Hence, Yamada et al do not disclose a ceramic heater constituted to have a structure such that a convex body or a convex portion formed on a surface of a ceramic substrate of the ceramic heater protrudes a distance from the surface of the ceramic substrate to make a one point contact to the semiconductor wafer, as defined in independent Claims 1 and 2. Furthermore, Yamada et al do not disclose a structure in which a convex body or a convex portion formed on a surface of a ceramic substrate of the ceramic heater has a conical shape, a pyramidic shape, a spire shape, spherical shape, or hemispherical shape, as defined in independent Claims 27 and 28.

Muka discloses a substrate heating apparatus. The plate 50 is preferably made of copper.[2] Considering the thermal expansion of metal, it is natural to assume that the heating plate 36 is also made of metal. Thus, Muka is related to a metal heater, not a ceramic heater. The technical base of Muka is different from that of the present invention. Therefore, the present invention is neither anticipated by nor made obvious over Muka.

Owing to the high thermal conductivity especially copper, uneven temperature distribution is not generated on the top surface 37 even if the heating elements 34 are formed in a heating element pattern. Further, the problem of contamination by impurities or a sintering aid as mentioned above does not exist in a metal heater. Therefore, it is not obvious over Muka that above-mentioned problems can be prevented by utilizing a convex body or a convex portion, since the effects of the present invention cannot be realized in a metal heater.

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[2] Muka, col. 2, lines 65-66.

Armstrong et al discloses an apparatus for heating. The apparatus includes a bakeplate 20 having protuberances 56 and heating zone 25 (Figs. la, lb and 1c). Armstrong et al do not teach about a material of the bakeplate 20. However, the bakeplate 20 is a relatively low thermal mass and thermally conductive.[3] Therefore, the bakeplate 20 is most likely metallic. Further, Armstrong et al do not teach about a contamination problem.

In addition, Armstrong et al teach about gap 62 between bakeplate 20 and semiconductor device 12.[4] The gap 62 is filled with gas, helium for example, to enhance the thermal conductivity. It is also mentioned that the gap 62 is used to pull a slight vacuum in order to hold wafer 12 in position. It is likely that the protuberances 56 are installed to make the gap 62 in order to enhance the thermal conductivity. Therefore, it is not obvious from Armstrong et al to utilize a convex body or a convex portion to suppress the contamination of a wafer.

Accordingly, the present invention is neither anticipated by nor made obvious in view of Armstrong et al. Further, there is no motivation to combine Yamada et al and Armstrong et al to obtain the ceramic heater of the present invention.

Regarding the combination of Yamada et al with Kobayashi et al, Kobayashi et al teach about a semiconductor-producing apparatus. Kobayashi.et al discloses:

> since aluminum nitride sintered body according to the present invention does not use a sintering aid or a blacking agent .., it causes no contamination. Therefore, the sintered body is most suitable as a material for high purity processing. In particular, the sintered body will not afford any serious adverse effect upon the semiconductor-producing process.

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[3] Armstrong et al, col. 8, lines 57 to 59.

[4] Id. col. 13, lines 19-36.

The sintered body, according to Kobayashi et al, is free from the contamination caused by impurities or a sintering aid.

Accordingly, there is no motivation to combine Yamada et al and Kobayash et al to form a convex portion or a convex body to hold a wafer apart from ceramic heater so that the contamination of the wafer can be suppressed.

Indeed, In re Rouffet, 149 F.3d 1350 sets forth criteria for being certain that impermissible hindsight is not being used to deprecate an invention.

> To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the examiner to show a motivation to combine the references that create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, ***confronted with the same problems as the inventor and with no knowledge of the claimed invention***, would select the elements from the cited prior art references for combination in the manner claimed.
>
> This court has identified three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art. In this case, the Board relied upon none of these. Rather, just as it relied on the high level of skill in the art to overcome the differences between the claimed invention and the selected elements in the references, it relied upon the high level of skill in the art to provide the necessary motivation. The Board did not, however, explain what specific understanding or technological principle ***within the knowledge of one of ordinary skill in the art would have suggested the combination***. Instead, the Board merely invoked the high level of skill in the field of art. If such a rote invocation could suffice to supply a motivation to combine, the more sophisticated scientific fields would rarely, if ever, experience a patentable technical advance. Instead, in complex scientific fields, the Board could routinely identify the prior art elements in an application, invoke the lofty level of skill, and rest its case for rejection. To counter this potential weakness in the obviousness construct, the suggestion to combine requirement stands as a critical safeguard against hindsight analysis and rote application of the legal test for obviousness. [emphasis added]

In the present case, the motivation in the outstanding Office Action does not show why one of ordinary skill in the art, when ***confronted with the same problems as the inventor and with no knowledge of the claimed invention***, would select the elements from the cited prior art references for combination in the manner claimed. Instead, the motivation cited appears to merely invoke the high level of skill in the field of art, and thus is based on impermissible hindsight analysis.

Hence, it is respectfully submitted that Claims 1, 2, 27, and 28 and the claims dependent therefrom patentably define over the applied prior art.

Consequently, in light of the present amendment and in view of the above discussions, the outstanding grounds for rejection are believed to have been overcome. This application as amended is believed to be in a condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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